

of farming as a business. Our scientific knowledge of agriculture, even at the present day, is in a very unsettled state. Theories have risen and fallen in a way which has led rent-paying farmers to regard science with indifference and suspicion. We find evidence of this feeling in our daily intercourse with them. To a large extent they are justified by the vagaries of some of the so-called scientists. I see only one feasible remedy for this, and that is the introduction of the necessary quantity of pure science into the education of the farming classes. This cannot be done in an agricultural college or two. It must be done on a national basis; that is, by establishing science classes in every middle-class college and school throughout the length and breadth of the land. And having done this, a few normal schools of agriculture would soon arise to complete and crown the work. If scientific instruction were placed on a national basis, the normal schools would become filled with the best minds in the country. In the absence of such a system an isolated school or college cannot prevent itself from doing mischief in one direction which has escaped attention; I mean, that if the best men do not enter it, inferior men acquire what I may call an artificial brand which enables them to obtain high positions in connection with agricultural industry—for example, as estate agents and managers—to the exclusion of men of superior natural powers, and to the detriment of the national interests. In other words, the natural law of Selection is subverted.

THOMAS BALDWIN

THE SHEEP

The History, Structure, Economy, and Diseases of the Sheep. By W. C. Spooner, M.R.V.C. Third Edition. (London: Lockwood and Co., 1874.)

THROUGHOUT the whole historic period the sheep has been a source of wealth to man. Mutton has been a staple article of human food, and wool one of the staple materials out of which fabrics have been made for human use. At no period in the history of the United Kingdom has the sheep been so much the object of the farmer's solicitude and care as at the present day. A new edition, purporting to be carefully revised and considerably enlarged, of a work exclusively devoted to the animal, from the pen of Mr. W. C. Spooner, V.S., is, therefore, manifestly entitled to attention. Mr. Spooner has written much. To Blackie's "Cyclopædia of Agriculture" he contributed several valuable papers on veterinary subjects. He has written several other thoughtful essays. He is best known as the editor of an edition of White's "Veterinary Art." The work now before us is the one by which he can best be judged as an author. The title of the volume is pretentious. It would lead the reader to expect an exhaustive treatise; but the most superficial examination corrects this impression.

The volume extends to 322 pages. It is divided into three parts. The first part contains eighty-two pages, and is devoted to the history of the several breeds of sheep. The second part treats of the structure and economy of the sheep, and contains 108 pages; and Part III., occupying the remainder of the text, is devoted to the diseases

of the animal. With one or two exceptions, the matter is arranged under these three heads. The exceptions are, however, unpleasant and unaccountable. This arises, to some extent, from treating of the structure and "economy" under one general heading. In this part of the work the author treats of breeding and feeding, which, according to his notions, are manifestly embraced in the term "economy." In the historical section of the book a good deal of information is given on the origin of new breeds, and it is to the repetition of some of this in the chapters on breeding, and the influence of ram sales in the second part of the book, that exception may justly be taken. Tautology, in this busy age, is a great fault. In the present instance it is the less pardonable, because it is not necessary, or even intended, to call back the mind to principles previously expounded.

In the account given of the several breeds no principle of classification appears to have been kept in view. The practical value of the facts is not, of course, lessened by this circumstance; but it must be admitted that the value of a book is greatly enhanced to the public by a proper classification and arrangement of its matter. Judged by this standard, Mr. Spooner's work is singularly defective. In an essay or chapter on breeding, in Part II., we are treated to a disquisition on the merits of the several kinds of sheep which should have been embodied in the description of the several breeds in Part I. In the section devoted to feeding, there are certain theoretical considerations on the size and structure of the chest and abdomen, which should have appeared in the account of the structure of those regions given in an earlier part of the same section.

It is a most ungracious task to write unfavourably of a work of this kind, but the truth is that this new edition affords evidence of great want of care and thought in its preparation. Words and phrases, and even whole sentences, occur throughout the work which illustrate this statement. Take, for example, the following sentence, which occurs in the section on feeding:—"The superiority of particular improved breeds is now generally acknowledged, and may indeed be considered to be established on certain principles, though in arriving at these principles it must be confessed that we are little indebted to science, but rather to the long and attentive observation and correct reasoning of practical men." Overlooking the defective structure of the whole of this sentence, we would observe that the author's view of the nature of science must be peculiar, to say the least of it. If attentive observation and correct reasoning be not science, we should like to know how science ever arose. It would seem as if speculative reasoning were synonymous with science in the mind of our author.

We take another illustration of the culpable want of care bestowed on the preparation of this work from the section devoted to the treatment of scab. Dipping in arsenic is first of all recommended as one of "the most simple and most effectual." Nothing has been said of the dangers attending the use of this substance, or of the consequences which have often followed its use. Mercurial ointment is also recommended. We are told that "tobacco-water is another remedy which has been found effectual, but the high duty it is subject to limits its application." The author ought to have known that tobacco used for this

purpose has been for some time exempt from duty on certain conditions. An excellent preparation, the *nicotine dip*, is thus manufactured.

We have had in view in the foregoing remarks the utility of this work to practical men who may seek in its pages facts and principles which would be of direct use and benefit to them in their pursuit of agricultural wealth. Possibly the author intends that it should become a text-book for the use of the 760 persons who, according to the last census, are learning farming professionally in England and Wales. Many of these will, it is to be hoped, in due time, become the agricultural luminaries of their country. It is of national importance that their minds should be thoroughly filled with the great truths of scientific agriculture. They can pick up facts readily enough on the several farms on which they reside; but to books they must look mainly for an exposition of scientific principles. To review this book, or any kindred work, in a way which would be of value to the agricultural student, would require more space than is at our disposal. We shall therefore select one subject well adapted to our purpose, and notice the author's treatment of it. That subject is breeding, which to the agricultural student and to the nation at large possesses the deepest possible interest. The section, or essay, on this subject is introduced under a high-sounding title—"The Principles and Practice of Breeding." We expected a masterly exposition of principles and an array of facts to maintain them. We have been disappointed. Some principles enunciated, which are either wholly or partially true, are illustrated by unhappy examples; and statements are made which are either questionable or contradicted by other statements. In common with many authors and breeders, Mr. Spooner is of opinion that in the offspring the characteristics of the male prevail in the majority of cases (p. 145). The discussion of this subtle topic would occupy much space. We cannot enter upon it now. But if the statement were true in the way Mr. Spooner puts it, the majority of lambs would be of the male gender; but it is not always so. In support of the above proposition we are reminded that "the mule partakes more of the nature of its sire, the ass, than of its dam, the mare." This is quite true; but is it not also true that the jennett is more like its dam, the ass, than its sire, the horse? The statements copied from one work into another on the paramount influence of the male are based partly on erroneous views, and partly on inadequate facts. Given a male and female equal in breeding, in age, and vigour of constitution, they will contribute equally to the characters of the offspring. As a rule the male in every class of live stock is better bred than the female; and as a matter of course the offspring partakes more of his characteristics. Mr. Spooner does not appear to have appreciated the hereditary influence. "Some farmers," he says, "are real advocates for a pure breed and a long pedigree, whilst others despise the pedigree and prefer gaining their ends by means of crossing. Each to a certain extent is right, and each wrong." We ask, how can any person be right to any extent, who despises pedigree? Again, we are told, in the same page, that "a long pedigree may be useless." We give Mr. Spooner credit for more intelligence than to believe he entertains the opinion which those words convey. Indeed, we go so far as to ex-

press our belief that, owing to the peculiar style in which he writes, his words do not always convey his real views. We find additional evidence of this in his remarks on breeding in-and-in. Any person conversant with the first principles of breeding knows that breeding in-and-in intensifies the hereditary influence. Two rams, for example, equal in size, age, shape, vigour, and quality, but differing in this—that one is closely bred, while the other is not, will leave their marks on the offspring in very different degrees. The one which is closely bred will, as every breeder of experience and intelligence knows, perpetuate his own points with much greater certainty than the other. According to the language of Mr. Spooner, we should look chiefly to the "resemblance" of the parents. "The stronger resemblance," he says, "there is between the qualities of both parents, if they are good, the more likely is it that the offspring will be perfect." While it is quite true that the nearer the sire and dam approach to each other in shape and quality the better, we are not to recognise this as the embodiment of any fundamental principle of breeding. One of the most difficult things the breeder of improved stock has to effect is to produce uniformity of type or resemblance. The question is, How is it to be done? The answer is this: Skill must be exercised in pairing animals until the desired qualities are produced; and those qualities once obtained, are fixed by close breeding. It is thus that the qualities of shorthorn cattle and Leicester sheep were permanently established. And it is thus, and thus only, that any breeder of our time, or of future time, can succeed in establishing an improved variety of our domestic animals.

In this section of his book, as well as in other parts of it, Mr. Spooner gives a large number of useful and instructive facts on the subject of crossing. We feel very great pleasure in adding that his remarks on this important subject will be worth many times the cost of the work to thousands of sheep-farmers in Great Britain.

CLOWES'S PRACTICAL CHEMISTRY

An Elementary Treatise on Practical Chemistry and Qualitative Inorganic Analysis, specially adapted for use in the Laboratories of Schools and Colleges, and by Beginners. By Frank Clowes, B.Sc. Lond., Science Master at Queenwood College. (London: J. and A. Churchill, 1874.)

IF the rate of progress of a science is to be measured by the number of text-books produced annually, Chemistry must assuredly advance with greater strides than any of its sister sciences. Whether this is actually the case we leave to our readers to judge, contenting ourselves here with pointing out the fact that while English Physics is represented by a few manuals, of which a considerable proportion are translations from foreign works, the market is, so to speak, glutted with an ever-increasing stock of chemical text-books.

The volume now before us is the production of a practised teacher of the science, and will doubtless be found of service outside the author's own classes. The work is divided into seven sections and an appendix. In the first section the student is introduced to experiments illustrating the methods of preparation and properties of